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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

January 9, 2003

REPLY TO THE ATTENTION OF
(SR-6J)

Mr. Alan Faust
Solutia, Inc.
W.G. Krummrich Plant
500 Monsanto Avenue
Sauget, IL 62206-1198

RE: Notification of Additional Work - DNAPL Characterization and Remediation
Study on Sauget Area 1 Site, St. Clair County, Illinois

Dear Mr. Faust:

On May 31, 2000, the United States Environmental Protection Agency (U.S. EPA) issued Solutia a Unilateral Administrative Order (UAO) requiring the emergency removal of contaminated sediments and soils from certain locations in and around Dead Creek including creek segments (CS) B (creek sediments, creek bed soils and flood plain soils); CS-C, D, E, and Site M (pond sediments and pond bottom pond soils). The UAO was amended in 2001 to include a portion of CS-F (creek sediments only) and the basin area located at the lift station. The UAO also requires installation of a 40 millimeter (mil) high density polyethylene (HDPE) liner in CS-B and post removal sampling in all excavated areas. The post removal sampling results will be used in the Area 1 EE/CA and RI/FS processes to determine what, if any, excavated areas in addition to CS-B may require further remediation under the EE/CA process. Solutia has recently completed the sediment removal and has collected the required post removal sampling as required by the UAO.

The Sauget Area 1 Site is currently the subject of a separate Administrative Order by Consent (AOC) signed by U.S. EPA, Solutia, and Monsanto Company on January 21, 1999, requiring a detailed Remedial Investigation and Feasibility Study (RI/FS) and Engineering Evaluation/Cost Assessment (EE/CA) of the Site including Dead Creek. CS-A, CS-B, CS-C, CS-D, CS-E and CS-F. Because the time-critical sediment removal action took place during the drafting of the EE/CA-RI/FS Report, neither the removal sampling results or an evaluation of current risks for Dead Creek have been incorporated into the EE/CA-RI/FS Report. Since the Area 1 EE/CA-RI/FS Report is nearly complete, a separate DNAPL Characterization and Remediation Study on Sauget Area 1 Site would seem appropriate.

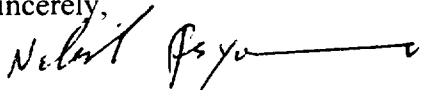
Pursuant to Section 2.5-Additional Work of the January 21, 1999, Administrative Order by Consent for the Sauget Area 1 Site, U.S. EPA has determined that additional work is

necessary to accomplish the objectives of the EE/CA Report and RI/FS Report. This additional work involves the preparation of a dense nonaqueous phase liquid (DNAPL) Characterization and Remediation Study for the Sauget Area 1 Site. Within 45 days of receipt of this letter, Respondent(s) shall submit to U.S. EPA for approval a draft DNAPL Characterization and Remediation Study for the Sauget Area 1 Site that is consistent with Section V, paragraph 2.2 and the SOW for the AOC. This DNAPL Study should focus on:

- The characterization and distribution of DNAPL within the middle and deep hydrogeologic units, the assessment of DNAPL migration under current and future site conditions, and the risk of uncontrolled DNAPL mobilization.
- The extent and properties of DNAPL (e.g. density, viscosity, and interfacial tension); as well as the timing of the DNAPL release; topography, property, and heterogeneity of geologic units on which the DNAPL may accumulate; the existence of ongoing DNAPL releases; and transport characteristics of the bedrock.
- The evaluation of the DNAPL remedial options and the evaluation of the benefits and costs associated with source removal technologies (thermal technologies such as steam injection and chemically-enhanced extraction such as the use of surfactants or co-solvents).

Attached to this letter is U.S. EPA's comments and recommendations regarding DNAPL issues. If you have any questions regarding this letter, please do not hesitate to contact me at 312/886-6840.

Sincerely,



Nabil Fayoumi
Remedial Project Manager
Superfund Division

Enclosure

cc: Linda W. Tape, Husch & Eppenberger, LLC
Thomas Martin, USEPA
Terry Stanuch, USEPA
Tim Gouger, USACE
Sandra Bron, IEPA
Kevin de la Bruere, USFWS
Michael Henry, IDNR
Karen Torrent, USDOJ

ATTACHMENT

January 09, 2003

MEMORANDUM

SUBJECT: Sauget Area 1 Superfund Site, Sauget, IL (02-R05-001)
Engineering Evaluation/Cost Analysis
Remedial Investigation/Feasibility Study

FROM: Steven D. Acree, Hydrogeologist
Technical Assistance and Technology Transfer Branch

TO: Mike Ribordy, RPM
U.S. EPA, Region 5

Per your request for technical assistance, the referenced document has been reviewed by Dr. Hai Shen and Steve Yarbrough of Dynamac Corporation and me. Dynamac Corporation is an off-site contractor providing technical support services to this laboratory. As requested, the review focused on issues related to the investigation of dense nonaqueous phase liquid (DNAPL) contaminants at the site and the evaluations of remedial options. In particular, the following questions were posed in the request for assistance:

- A) It appears that the possibility of DNAPL movement on top of the fractured bedrock, within the weathered bedrock zone, has not been evaluated. Is this a potential migration pathway that needs further characterization? Are there other migration pathways that were also missed?
- B) The assessment of remedial options in the Source Evaluation Study included natural flushing and intensive pumping only. What are the other remedial options that should have been evaluated? Are there technical limitations that should be considered at this site concerning other remedial options that require additional site characterization?

In general, the studies reported in this document were not sufficient to adequately address concerns regarding DNAPL distribution and potential mobility under current and future conditions. This is particularly true at the bedrock interface with the deep hydrogeologic unit. Data indicate the presence of DNAPL but the extent is unknown and current mobility is assumed in the report to be minimal without supporting evidence. In similar fashion, it appears that the evaluation of remedial options should have been expanded to include an evaluation of the benefits and costs associated with more aggressive source removal technologies (e.g., thermal technologies and chemical enhancements to conventional extraction). Detailed comments regarding these issues and other areas of concern are provided below.

1. The characteristics and distribution of DNAPL within the middle hydrogeologic unit and, especially, the deep hydrogeologic unit (DHU) was not sufficiently investigated during these studies to allow adequate assessment of DNAPL migration under current and future scenarios. The document describes the installation and sampling of a small number of wells placed at the deep alluvial aquifer - bedrock interface. The results indicate that the interface may be highly fractured and that DNAPL may be present. Based on this limited information, the interface may serve as a preferential pathway for DNAPL migration and allow additional migration into bedrock fracture systems. However, the extent and properties of DNAPL at this depth and the transport characteristics of the bedrock were not determined.

The report assumes that DNAPL distribution is stable and no additional migration is occurring based on general discussions obtained from literature sources. However, DNAPL mobility at this site depends on many factors and is difficult to accurately access. Mobility is controlled by factors such as the physical properties (e.g., density, viscosity, and interfacial tension) as well as the volume and timing of the DNAPL releases; topography, properties, and heterogeneity of geologic units on which the DNAPL may accumulate; and the existence of ongoing DNAPL releases (e.g., continued rupture of buried drums). It did not appear that the site was evaluated with respect to such factors. It is also noted that DNAPL mobility may increase in the future due to changes in conditions such as onset of water production for industrial uses in areas adjacent to the site. Such scenarios were not considered.

At a minimum, it is recommended that additional information concerning DNAPL distribution in the area of the bedrock interface, particularly the extent of any significant DNAPL accumulations, and properties (e.g., density, viscosity, and gross chemical composition) of the DNAPL, if found, be obtained to better evaluate the potential for additional DNAPL migration. An initial step in this investigation would be to monitor wells screened at the top of bedrock, particularly well BR-I, for DNAPL accumulation. Data concerning bedrock topography beneath source areas and hydrologic properties of the bedrock and interface would be required to facilitate these evaluations. This information is also needed in the assessment of other remedial options involving source removal and ground-water extraction in the DHU. Additional technical guidance regarding the evaluation of DNAPL sites is available from the USEPA Fact Sheet entitled "DNAPL Site Characterization" and from "DNAPL Site Evaluation" by Robert Cohen and James Mercer (CRC Press, 1993). A copy of the Fact Sheet is enclosed.

2. The evaluations of remedial options for source removal in the MHU and DHU (Section 9 and Appendix D) of the document were limited to a comparison of conventional ground-water extraction technology operated for only 30 years and contaminant flushing under natural hydraulic gradients. Although the analyses would have resulted in a more significant reduction in restoration time frame if the extraction system was assumed to operate until contaminant concentrations met restoration goals, conventional pump-and-treat technology is relatively ineffective for the objective of rapid subsurface restoration given site conditions such as those at Sauget Area 1. It is recommended that the costs and benefits of a more aggressive source removal technology be evaluated in order to more accurately reflect the range of current

remediation technologies. Emerging technologies are capable of much greater contaminant mass removal within reasonable time frames than can be achieved using conventional pump-and-treat technology. It is recommended that the document evaluate representative thermal technologies, such as steam injection, and chemically-enhanced extraction, such as the use of surfactants or co-solvents. Based on the contaminant distribution at this site, it appears that application of such technologies to the shallow hydrogeologic unit/fill areas would also be required to reduce future impacts to the deeper units.

Potential benefits of such aggressive source removal include significant reduction in remedial time frames and, possibly, plume size under natural conditions. The benefits of DNAPL removal may also include a reduction in the mobility under current and future scenarios and should be considered in these analyses. However, difficulty in locating all source materials and site conditions such as geologic heterogeneity and contaminants within low-permeability or fractured materials present practicable limitations to rapid DNAPL site restoration. Removal effectiveness close to 100% would likely be required for rapid restoration. It should also be noted that a treatment train approach using a combination of aggressive removal technologies may ultimately be required to maximize benefits. It is likely that the use of such technologies will not negate the need for hydraulic containment for some period of time. In addition, it is noted that the risk of uncontrolled DNAPL mobilization is also of concern. Such risks may be evaluated and mitigated by thorough site characterization and certain remedial designs but not eliminated.

For the purposes of this report, it is suggested that these aggressive technologies be evaluated using a range of assumptions concerning site conditions and current cost information available from vendors. The potential benefits in terms of reduction in restoration time frames may be analyzed using methods similar to those of Appendix D using a range of assumptions concerning the effectiveness of source removal in order to maintain a consistent basis for comparison. The report notes that treatability studies would be required prior to implementation of several of the remedial options that were evaluated. In similar fashion, information regarding dimensions of contaminant source zones, contaminant properties and distributions within these zones, hydrogeologic properties, and other data particular to the chosen technologies would be required prior to implementation. Bench scale treatability studies would likely be necessary due to the potentially complex nature of DNAPLs present at this site and pilot studies may also be warranted to better assess effectiveness with respect to remedial action objectives.

3. The potential benefits and weaknesses of a pulsed pumping remedial scenario were also considered during this review. In this scenario, conventional extraction wells are pumped until the contaminant concentrations in the extracted water decline to a pre-determined level at which point pumping is ceased until concentrations rebound. Such operation may result in a reduction in operating costs per unit mass of extracted contaminants compared to the high volume pump-and-treat system included in the remedial options. However, this remedial option still relies on contaminant dissolution from nonaqueous phase liquids into ground water prior to removal. The efficiency and effectiveness of this scenario for the objective of source removal or subsurface

restoration would be relatively low. Time frames for restoration may be between those required for the natural flushing and extraction options evaluated in the referenced document. In addition, there is increased concern with respect to the maintenance of hydraulic capture using pulsed-pumping operations. The technology may be most useful as a component of a treatment train following aggressive source removal using technologies such as those discussed above.

If you have any questions concerning this review, please do not hesitate to call me at your convenience (580-436-8609). We look forward to future interactions with you concerning this and other sites.

Enclosure

cc: Rich Steimle (5102G)
Larry Zaragoza (5204G)
Luanne Vanderpool, Region 5
Doug Yeskis, Region 5